1. Factor the polynomial below completely, knowing that $x-2$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 20x^4 - 143x^3 + 212x^2 + 33x - 90$$

   A. $z_1 \in [-2, -1.6]$, $z_2 \in [0.98, 1.85]$, $z_3 \in [1.93, 2.08]$, and $z_4 \in [4.45, 5.68]$

   B. $z_1 \in [-5.3, -3.4]$, $z_2 \in [-2.67, -1.65]$, $z_3 \in [-1.14, -0.62]$, and $z_4 \in [-0.5, 1.45]$

   C. $z_1 \in [-1.5, 0.4]$, $z_2 \in [0.49, 1.03]$, $z_3 \in [1.93, 2.08]$, and $z_4 \in [4.45, 5.68]$

   D. $z_1 \in [-5.3, -3.4]$, $z_2 \in [-2.67, -1.65]$, $z_3 \in [-0.68, 0.13]$, and $z_4 \in [2.83, 3.55]$

   E. $z_1 \in [-5.3, -3.4]$, $z_2 \in [-2.67, -1.65]$, $z_3 \in [-1.51, -1.1]$, and $z_4 \in [0.65, 2.43]$

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2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder $r$.

$$\frac{10x^3 - 64x^2 + 74x - 25}{x - 5}$$

   A. $a \in [9, 14]$, $b \in [-15, -6]$, $c \in [2, 5]$, and $r \in [-9, -1]$.

   B. $a \in [9, 14]$, $b \in [-119, -108]$, $c \in [642, 645]$, and $r \in [-3249, -3242]$.

   C. $a \in [43, 53]$, $b \in [-320, -306]$, $c \in [1641, 1645]$, and $r \in [-8246, -8238]$.

   D. $a \in [43, 53]$, $b \in [180, 194]$, $c \in [1000, 1007]$, and $r \in [4994, 4996]$.

   E. $a \in [9, 14]$, $b \in [-32, -17]$, $c \in [-24, -21]$, and $r \in [-119, -110]$.

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3. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 16x^3 + 40x^2 + x - 30$$

   A. $z_1 \in [-0.65, -0.05]$, $z_2 \in [1.8, 2.3]$, and $z_3 \in [4.98, 5.07]$

B. $z_1 \in [-2.18, -1.53]$, $z_2 \in [-0.83, -0.62]$, and $z_3 \in [1.25, 1.67]$

C. $z_1 \in [-1.67, -1.19]$, $z_2 \in [0.74, 1.09]$, and $z_3 \in [1.9, 2.6]$

D. $z_1 \in [-0.91, -0.62]$, $z_2 \in [1.04, 1.44]$, and $z_3 \in [1.9, 2.6]$

E. $z_1 \in [-2.18, -1.53]$, $z_2 \in [-1.34, -1.21]$, and $z_3 \in [0.49, 0.83]$

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4. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 7x^3 + 3x^2 + 4x + 4$$

A. $\pm 1, \pm 2, \pm 4$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 7}$

C. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2, \pm 4}$

D. $\pm 1, \pm 7$

E. There is no formula or theorem that tells us all possible Integer roots.

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5. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^3 + 71x^2 + 32x - 48$$

A. $z_1 \in [-0.31, 0]$, $z_2 \in [3.4, 5.2]$, and $z_3 \in [2.8, 5.1]$

B. $z_1 \in [-1.74, -1.25]$, $z_2 \in [0, 1.2]$, and $z_3 \in [2.8, 5.1]$

C. $z_1 \in [-4.13, -3.86]$, $z_2 \in [-1.2, -0.2]$, and $z_3 \in [1.4, 2.1]$

D. $z_1 \in [-0.81, -0.46]$, $z_2 \in [0.9, 2.3]$, and $z_3 \in [2.8, 5.1]$

E. $z_1 \in [-4.13, -3.86]$, $z_2 \in [-2.6, -1.1]$, and $z_3 \in [0.3, 1.1]$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder $r$.

$$\frac{20x^3 + 105x^2 - 122}{x + 5}$$

A. $a \in [-103, -96], b \in [598, 607], c \in [-3033, -3021]$, and $r \in [15001, 15007]$.

B. $a \in [17, 23], b \in [200, 209], c \in [1024, 1033]$, and $r \in [4999, 5011]$.

C. $a \in [17, 23], b \in [-2, 9], c \in [-25, -22]$, and $r \in [-2, 10]$.

D. $a \in [-103, -96], b \in [-400, -393], c \in [-1977, -1970]$, and $r \in [-10001, -9989]$.

E. $a \in [17, 23], b \in [-15, -14], c \in [88, 95]$, and $r \in [-665, -656]$.

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7. Factor the polynomial below completely, knowing that $x - 4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^4 + 14x^3 - 163x^2 - 129x + 180$$

A. $z_1 \in [-4.9, -3.6]$, $z_2 \in [-3.06, -2.98], z_3 \in [0.27, 0.47]$, and $z_4 \in [4.4, 6.6]$

B. $z_1 \in [-4.9, -3.6]$, $z_2 \in [-1.49, -1.28], z_3 \in [0.66, 0.7]$, and $z_4 \in [4.4, 6.6]$

C. $z_1 \in [-5.6, -4.8]$, $z_2 \in [-1.51, -1.49], z_3 \in [0.7, 0.79]$, and $z_4 \in [2.9, 4.2]$

D. $z_1 \in [-5.6, -4.8]$, $z_2 \in [-0.68, -0.65], z_3 \in [1.25, 1.37]$, and $z_4 \in [2.9, 4.2]$

E. $z_1 \in [-4.9, -3.6]$, $z_2 \in [-0.78, -0.72], z_3 \in [1.49, 1.51]$, and $z_4 \in [4.4, 6.6]$

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8. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 3x^4 + 4x^3 + 6x^2 + 3x + 5$$

A. $\pm 1, \pm 5$

B. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 3}$

C. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 5}$

D. $\pm 1, \pm 3$

E. There is no formula or theorem that tells us all possible Integer roots.

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder $r$.

$$\frac{15x^3 + 70x^2 + 105x + 53}{x + 2}$$

A. $a \in [-30, -29], \; b \in [128, 137], \; c \in [-163, -151], \text{ and } r \in [358, 366].$

B. $a \in [14, 17], \; b \in [97, 101], \; c \in [298, 307], \text{ and } r \in [663, 668].$

C. $a \in [14, 17], \; b \in [39, 45], \; c \in [23, 27], \text{ and } r \in [3, 4].$

D. $a \in [14, 17], \; b \in [20, 29], \; c \in [30, 33], \text{ and } r \in [-37, -31].$

E. $a \in [-30, -29], \; b \in [9, 11], \; c \in [123, 128], \text{ and } r \in [296, 309].$

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10. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder $r$.

$$\frac{6x^3 + 26x^2 - 29}{x + 4}$$

A. $a \in [3, 10], b \in [2, 4], c \in [-11, -5], \text{ and } r \in [-6, 5].$

B. $a \in [-27, -20], b \in [117, 124], c \in [-488, -487], \text{ and } r \in [1917, 1927].$

C. $a \in [3, 10], b \in [-9, 1], c \in [18, 21], \text{ and } r \in [-129, -128].$

D. $a \in [-27, -20], b \in [-73, -64], c \in [-280, -274], \text{ and } r \in [-1151, -1146].$

E. $a \in [3, 10], b \in [47, 52], c \in [194, 202], \text{ and } r \in [769, 776].$

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